Improved Lyman Ultraviolet Astronomy Capabilities through Enhanced Coatings

Completed Technology Project (2016 - 2019)

Project Introduction

The proposed mission Large UV/Optical/IR (LUVOIR) Surveyor observatory, a 8-16 m aperture telescope covering 91 nm - 10 µm spectral range, will greatly contribute to unveil fundamental information, related with the primary NASA goals, such as the history of galaxies, the Milky Way and its neighbors, the origins of stars and planets, demographics of planetary systems, the search for life. However, the short-wavelength coverage and performance will be greatly determined by the performance of coatings. In fact, to achieve high-reflectance broadband coatings has been identified as an "Essential Goal" in the technology needs for the LUVOIR Surveyor. Moreover, according to the report "From Cosmic Birth to Living Earths, the Future of UVOIR Space Astronomy", AURA, (2015), obtaining broadband coatings with a performance of >50–70% reflectance below 120 nm is an immediate, high-priority technology investment area, fundamental to mission feasibility, that needs further development. Pure Aluminum presents high reflectance over the whole LUVOIR target spectral range, although it has to be protected from oxidation with a thin film of a transparent material. Above 102 nm there are still some transparent materials (LiF, MgF2, AlF3) that are fundamental to obtain relatively efficient coatings; Al protected with fluorides among LiF or MgF2 have been the most used solutions. But below 102 nm down to 91 nm, no transparent material is available to protect Al and coating mirror reflectance stays below 40%. But even above 102 nm, the reflectance of protected Al is limited by the residual absorption of the fluoride. This proposal aims to enhance the LUV reflectivity of standard Al coatings by either depositing a denser and less absorbent fluoride films onto Al, through techniques such as Ion Assisted Physical Vapor Deposition (IAPVD), or by protecting Al either with a very thin film such as a fluoride film prepared by Atomic Layer Deposition (ALD). If any of the aforementioned methods work satisfactorily, this would lead to a LUV technology which would ultimately enable new scientific imaging capabilities.

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Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Responsible Program:

Astrophysics Research and Analysis

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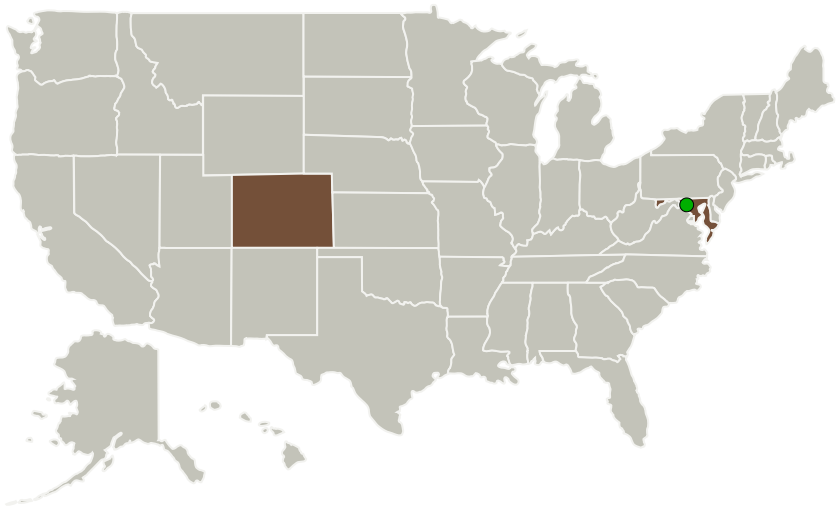
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
Colorado	Maryland

Project Management

Program Director:

Michael A Garcia

Program Manager:

Dominic J Benford

Principal Investigator:

Manuel A Quijada

Co-Investigators:

Brian Fleming
Javier G Del Hoyo
David T Leisawitz
Edward J Wollack
Vivek H Dwivedi
Raymond A Adomaitis

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.1 Materials
    - TX12.1.5 Coatings

Target Destination

Outside the Solar System